NAVFACENGCOM SOUTHWEST MEMORANDUM

TO:	**PHILLIP RAMSEY, USEPA REGION 9** **MANJULIKA CHAKRABARTI, CAL/EPA DTSC** **KAI DUNN, CRWQCB, LAHONTAN REGION**
FROM:	**KRISTINA MADALI, NAVFAC SOUTHWEST**
SUBJECT:	**RESPONSE TO COMMENTS AND DRAFT FINAL 'FINAL PROPOSED PLAN,' FOR NEBO SOUTH GROUNDWATER, OPERABLE UNIT 2, MARINE CORPS LOGISTICS BASE BARSTOW, CA, JUNE 2006**
DATE:	**7 JUNE 2006**
CC:	**MICHAEL COX, MCLB BARSTOW** **DR. BILL MABEY, TECHLAW, INC.** **ADMINISTRATIVE RECORD**

Dear Barstow FFA Team Members:

The Response to Comments (RTCs) for the draft 'Final Proposed Plan' and Draft Final 'Final Proposed Plan' for Nebo South Groundwater, Operable Unit 2, Marine Corps Logistics Base (MCLB) Barstow, CA, dated June 2006, written by TetraTech EC, Inc. (TtEC) were sent to you on June 2, 2006 for delivery on June 5, 2006.

We made minor revisions to the Draft Final Proposed Plan sent to you on June 2, 2006. These revisions included using the abbreviation, 'DON' in place of 'Navy' throughout the document, and changing the public comment period to June 21, 2006 to July 21, 2006. The revised version is attached. Please refer to this revised version for all future use.

The RTCs document sent along with the Draft Final 'Final Proposed Plan' was also revised to reflect the abbreviation 'DON' in place of 'Navy'. Please refer to the attached revised version for all future use.

As agreed to under Section 7.3(a) of the Federal Facility Agreement signed 24 October 1990, please provide any comments within 30 days, or by 9 July 2006.

If you have any questions, please contact the undersigned at (619) 532-1737 or by email at Kristina.Madali@navy.mil. You may also contact Michael Cox at (760) 577-6811 or by email at michael.cox@usmc.mil.

Sincerely,
Kristina Madali
Remedial Project Manager

TETRA TECH EC, INC.

TRANSMITTAL/DELIVERABLE RECEIPT

Contract No. N68711-98-D-5713 (RAC III)

Document Control No. 06-0858-1

File Code: 5.0

TO: Contracting Officer
Naval Facilities Engineering Command
Southwest
Ms. Beatrice Appling, AQE.BA
1220 Pacific Highway
San Diego, CA 92132-5190

DATE: 06/09/06
CTO: 0096
LOCATION: Yermo Annex, Barstow

FROM: Edwin Neil Hart
Neil Hart, Program Manager

DESCRIPTION: Draft Final Final Proposed Plan, Nebo South Groundwater - Operable Unit 2 - Marine Corps Logistics Base Barstow, June 2006

(Resubmitting on June 9, 2006 with minor changes (Abbreviation and Public Comment Period).

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Basic Contract File (02R1)	P. Ramsey - US EPA	
1C	B. Mabey - TechLaw,Inc	
	K. Dunn - CRWQCB	

Installation Restoration Program
Draft Final
Final Proposed Plan
NEBO SOUTH GROUNDWATER - OPERABLE UNIT 2, MARINE CORPS LOGISTICS BASE BARSTOW

NAVFAC Southwest

Barstow, California **June 2006**

INTRODUCTION

The Department of the Navy (DON) presents this Proposed Plan in order that the DON may obtain input from the public and finalize a decision for an environmental cleanup action at Marine Corps Logistics Base (MCLB) Barstow. This proposed plan identifies the DON's Preferred Plan for cleaning up contaminated groundwater using air sparging/soil vapor extraction (*AS/SVE*) and institutional controls/land use controls at the MCLB Barstow's Operable Unit (*OU*) 2 Nebo South *groundwater plume*. MCLB Barstow is located in the central Mojave Desert region of San Bernardino County, California, and consists of the Nebo Main Base and the Yermo Annex (Figure 1 on Page 2). The Nebo Main Base, which also includes the rifle range, covers an area of approximately 4,006 acres. The Nebo Main Base is located on the eastern edge of Barstow, California, north of Interstate 40 and south of the Mojave River.

Three distinct *plumes* of *groundwater* contaminated with volatile organic compounds (*VOCs*) were identified at MCLB Barstow: one at *OU* 1 referred to as the Yermo Annex *plume*, and two at *OU* 2 referred to as the Nebo Main Base North and South *plumes*. Based on detailed field investigations, engineering reports, and public input, a *Record of Decision (ROD)* was signed in April 1998 detailing the specific remedial alternatives for *OUs* 1 and 2. Remedial alternatives proposed for the Yermo Annex *groundwater plume* under *OU* 1 and the Nebo Main Base North *groundwater plume* under *OU* 2 were deemed final. An interim remedial alternative was selected for the Nebo Main Base South *plume* of *OU* 2 (referred to as the Nebo South *plume*).

The interim remedial action that was documented for the *OU* 2 Nebo South *groundwater plume* in a 1998 Final *ROD* for *OU* 1/*OU* 2 called for off-Base *groundwater* extraction and treatment and institutional controls/land use controls; however, the interim remedy for the Nebo South *plume*, as documented, has not been implemented to date. For the most part, the extent of the Nebo South *plume* has been limited to a small area (approximately, 2.28 acres) on-Base near the Base's southeast boundary. If implemented, *groundwater* extraction by off-Base wells could potentially result in the *VOC* contamination migrating off Base. Furthermore, at the time of signing the *OUs* 1 and 2 *ROD*, an *AS/SVE* pilot test was underway at the *OU* 2 Nebo South, and the results were noted to be inconclusive. Therefore, the interim Nebo South plume (*OU* 2) *ROD* proposed that the final remedy for the Nebo South *plume* be selected and that the final Proposed Plan and *ROD* be completed following collection and evaluation of the *AS/SVE* pilot test data.

Subsequent analysis of the *AS/SVE* pilot test results indicated that the *AS/SVE* technology would be the most effective technology to clean up *groundwater* contamination in the Nebo South *plume*. Application of *AS/SVE* has already resulted in significant reduction of the Nebo South *plume* extent. Therefore, the Final Proposed Plan for the Nebo South *plume* (*OU* 2) proposes *AS/SVE* as the preferred alternative.

Dates to remember: ***MARK YOUR CALENDAR***

PUBLIC COMMENT PERIOD:
June 21, 2006 to July 21, 2006
The DON will accept written comments on the Proposed Plan during the public comment period.

PUBLIC MEETING:
June 28, 2006 (7 p.m. to 9 p.m.)
The DON will hold a public meeting in the form of an open house meeting to explain the Proposed Plan. This meeting will be held at the Ramada Inn located at 1511 E. Main Street, Barstow, CA (Phone: 760-256-5673). Oral and written comments will also be accepted at the meeting.

For more information, see the Administrative Record at the following locations:
Marine Corps Logistics Base Barstow
Installation and Logistics Department
Environmental Division
Warehouse 3
Barstow, CA 92311-5013
(760) 577-6744

Commanding Officer
Naval Facilities Engineering Command, Southwest
Attn: CERCLA Administrative Department
1220 Pacific Highway
San Diego, CA 92132

The information contained in this Proposed Plan is based on detailed field investigation and engineering reports prepared for *OU* 2. The primary documents are the Remedial Investigation (*RI*) Report for *OUs* 1 and 2 (October 1995), the Feasibility Study (*FS*) Report for *OUs* 1 and 2 (June 1996), the *ROD* for *OUs* 1 and 2 (April 1998),

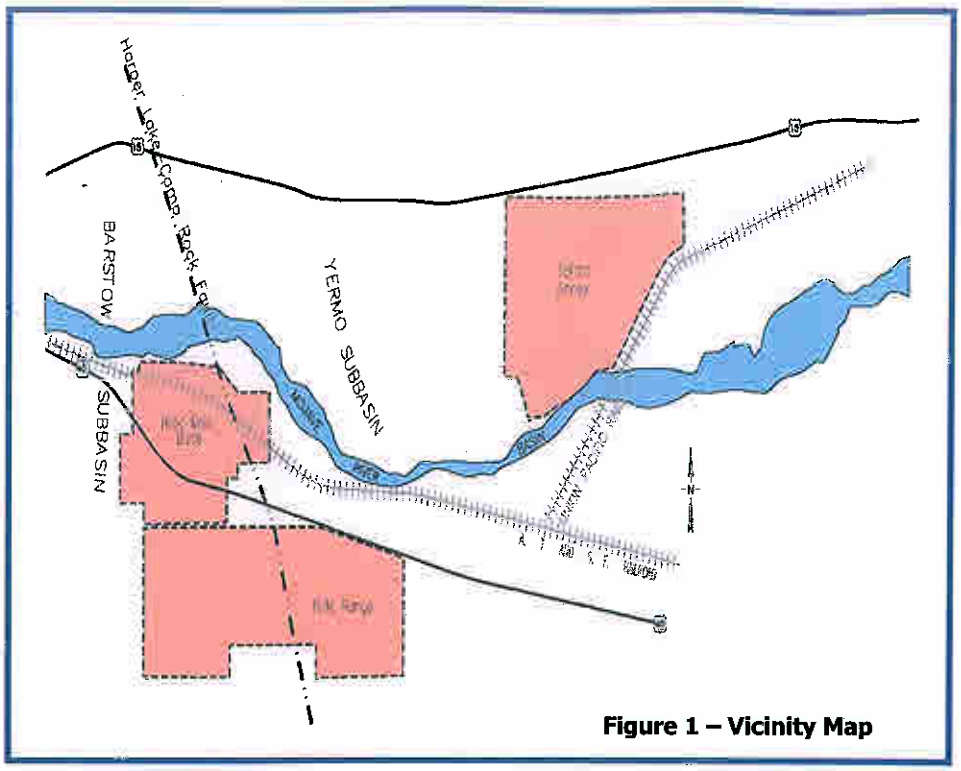

Figure 1 – Vicinity Map

Five-Year Review Report (December 2002), Final Interim Remedial Action Construction Report (July 2004), various *Groundwater* Monitoring Reports, and the Draft Final Technical Memorandum – Evaluation of Off-Base Extraction (April 2005). These reports are part of the MCLB Barstow *Administrative Record* and are available for public review. Addresses and telephone numbers for the *Administrative Record* locations are provided on the front page.

The DON is issuing this Proposed Plan as part of its public participation responsibilities under *Section 117(a)* of the Comprehensive Environmental Response, Compensation, and Liability Act (*CERCLA*) and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (*NCP*), also known as the "Superfund" program. The DON, in consultation with the regulatory agencies, will select a final remedy for the site after reviewing and considering all information submitted during the 30-day public comment period. The regulatory agencies include the U.S. Environmental Protection Agency (EPA) and two agencies of the California EPA: the Department of Toxic Substances Control (DTSC), and the California Regional Water Quality Control Board (Water Board) – Lahontan Region.

SITE BACKGROUND

MCLB Barstow was established in 1942 at the Nebo Main Base (Figure 1) as a staging area for supplies and equipment for Marine Corps forces deployed in the Pacific during World War II. Yermo Annex (Figure 1) was acquired in 1946 because Nebo Main Base operations outgrew increasing mission requirements. The Rifle Range (Figure 1) was acquired in the mid-1950s for shooting practice.

During its 50 years of operation through 1992, MCLB Barstow had generated industrial waste such as waste oil, fuel, solvent, paint residue, grease, hydraulic fluid, battery acid, various gases, and other components, including some that are sources of low-level radiation. Additional waste generated included pesticides, herbicides, polychlorinated biphenyls, calcium hypochlorite, and sodium hypochlorite. In the early years, some of these wastes were disposed of in landfills, burn trenches, and other areas located throughout the Nebo Main Base and the Yermo Annex.

With the passage of *CERCLA* in 1980, the DON began the Installation Restoration (IR) Program to identify, investigate, and clean up past hazardous waste disposal sites. MCLB Barstow and the DON have been actively involved in this program since the early 1980s. In November 1989, the Base was placed on the *CERCLA* National Priorities List (*NPL*) due to the presence of soil and *groundwater* contamination. In October 1990, MCLB Barstow entered into a Federal Facilities Agreement (FFA) with the EPA, DTSC, and Water Board. The FFA is a legally binding agreement between the MCLB Barstow and the regulatory agencies. The FFA specifies a schedule for completing the *CERCLA* investigation and remediation activities and defines seven *OUs* at the Base. *OU* 1 and *OU* 2 address the *groundwater* contamination at the Yermo Annex and the Nebo Main Base, respectively. *OU* 3, *OU* 4, *OU* 5, and *OU* 6 address soil contamination at 36 *CERCLA* Area of Concerns (*CAOCs*). *OU* 7 was created to include any additional *CAOCs* that may be identified from the ongoing Resource Conservation and Recovery Act (*RCRA*) Facility Assessment at the Base. The source area for the Nebo South *plume* was identified as the *CAOC* 6 area (Figure 2 on Page 3). This Final Proposed Plan focuses on the preferred alternative for the Nebo South *plume* under *OU* 2.

Remedial Investigation

The *RI* activities for *OU* 1 and *OU* 2 were conducted within the framework of the FFA to define regional hydrogeologic conditions and to assess the nature and extent of *groundwater* contamination at the Base. Phase I *RI* activities were conducted between February and December 1992. The Phase I *RI* identified the presence of *VOCs* exceeding Maximum Contaminant Levels (*MCLs*) in *groundwater* at both the Yermo Annex and the Nebo Main Base.

Phase II *RI* activities, conducted between June and September 1994, focused on defining the vertical and lateral extent of *groundwater* contamination detected in

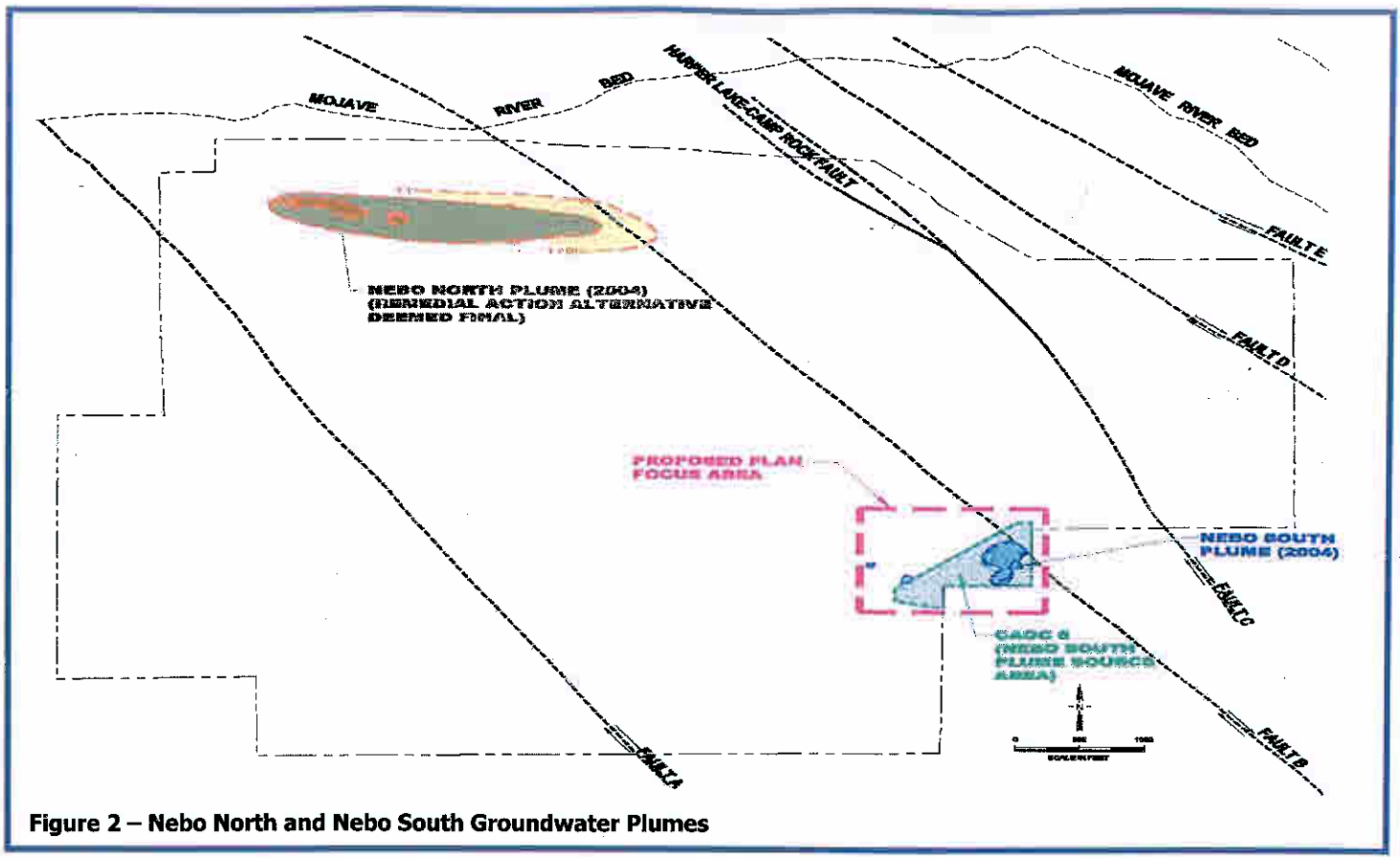

Figure 2 – Nebo North and Nebo South Groundwater Plumes

Phase I. The Phase II results were documented in the Draft Final *RI* Report (October 1995).

The *RI* results for Nebo South indicated that *VOCs* are the primary class of chemicals affecting *groundwater* in the Nebo Main Base South area. Trichloroethene (TCE), tetrachloroethene (PCE), and 1,2-dichloroethane (1,2-DCA) were detected at concentrations exceeding their federal and/or state drinking water standards. Other *VOCs* detected at levels not exceeding federal or state standards included 1,1-dichloroethene (1-1-DCE), chloroform, bromoform, dibromochloromethane, and bromodichloromethane.

TCE was concluded to be the predominant contaminant in *groundwater* at the Nebo South *plume*. Recent *groundwater* monitoring data indicates that TCE is the only contaminant detected above its *MCL* in the Nebo South *plume*. Figure 3 (Page 4) shows the interpreted lateral extent of TCE in 1996. The Nebo South *plume* appears to be the result of historical releases and disposal practices for solvents at the *CAOC* 6 in the Nebo South area between 1946 and 1952. Practices included disposing of waste liquids in revetments at this *CAOC*.

Remedial Actions – Nebo South Plume

An *AS/SVE* pilot test at *CAOC* 6 (conducted in 1996, and termed "Phase 1 testing") had provided inconclusive results as to its effectiveness at the time, which resulted in the containment strategy by extraction being the only viable option during development of the interim remedy for Nebo South in the *OUs* 1 and 2 *ROD* (April 1998).

Subsequent re-evaluation of the Phase 1 *AS/SVE* test data indicated that *AS/SVE* was potentially feasible. This was followed by implementation of additional *AS/SVE* testing (termed Phase 2 testing). The Phase 2 SVE and AS systems were started in November 2001 and January 2002, respectively. The Phase 2 test confirmed that *AS/SVE* was, in fact, feasible. Based on the success of the Phase 2 testing, an interim remedial action consisting of adding additional *AS/SVE* wells to treat the on-Base *VOC plume* was proposed and implemented. These *AS/SVE* wells have been in operation as of October 2005.

Groundwater monitoring data following the implementation of the Phase 1 and Phase 2 *AS/SVE* pilot data indicates a substantial decrease in TCE concentrations when compared to the 1996 TCE concentrations. Figures 3, 4, and 5 (Page 4) show the areal extents of the Nebo South *plume* based on 1996, 2000, and 2004 data. Data collected during 2000 and 2004 (Figures 4 and 5) show substantial reduction in the areal extent of the TCE *plume* when compared to the 1996 areal extent of the *plume*. The *AS/SVE* has been very effective in reducing the TCE concentrations of the Nebo South *plume*.

Groundwater TCE concentrations to the east of Fault B have historically been non-detect or detected at relatively low concentrations (below *MCL*). Accordingly, the TCE concentration contour is not shown extending beyond the fault line.

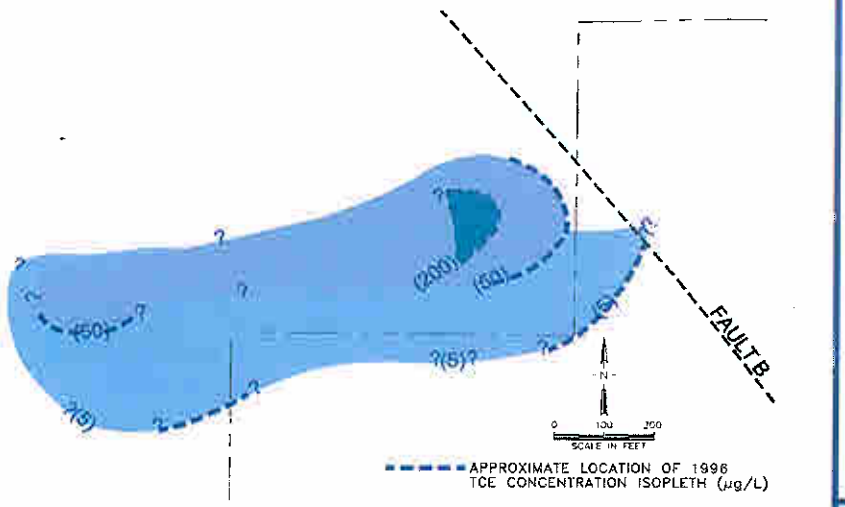

Figure 3 – Interpreted Lateral Extent of TCE in Groundwater - 1996

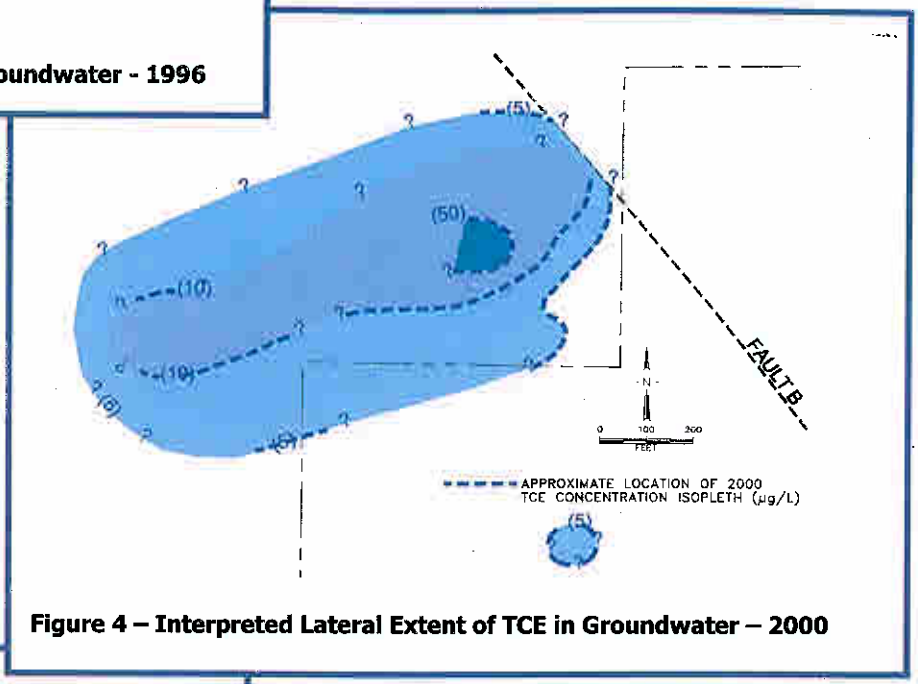

Figure 4 – Interpreted Lateral Extent of TCE in Groundwater – 2000

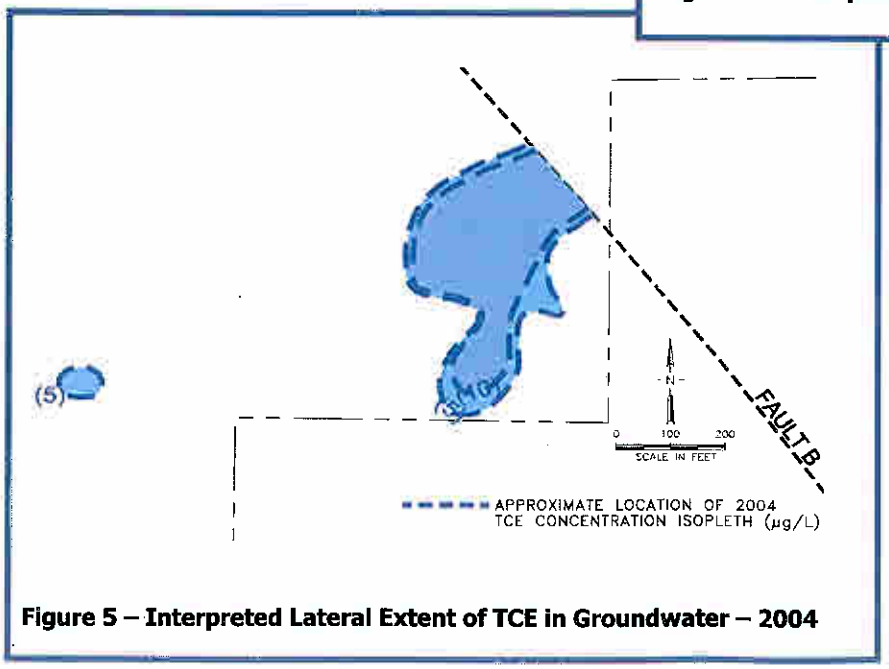

Figure 5 – Interpreted Lateral Extent of TCE in Groundwater – 2004

SITE CHARACTERISTICS

The Nebo Main Base topographic surface slopes gently north toward the Mojave River at the Nebo Main Base, which is the dominant surface water feature in the Mojave Desert. The Mojave River originates as a series of interconnecting drainages along the northeast front of the San Bernardino Mountains, extends east-northeast from the mountain front, passes through the Base, and terminates at Soda Lake about 70 miles east of the Base. Because the river is primarily fed by mountain front drainages, the riverbed is generally dry; flows in the Barstow area are limited to periods of heavy rainfall. Surface flow is also evident near areas of bedrock highs and intermittently along the Harper Lake-Camp Rock Fault near the Nebo Main Base.

MCLB Barstow is partly within the 100-year floodplain of the Mojave River, which passes through the northern portion of Nebo Main Base and the southern portion of the Yermo Annex. On-site flooding at the Nebo Main Base is rare. The surface water drainage system at Nebo Main Base has been designed to intercept and convey runoff water to the Mojave River.

Several *groundwater* production wells at the Nebo Main Base were abandoned due to *groundwater* degradation (there was no *groundwater* production after 1975). In 1977, the Nebo Main Base was connected to the Southern California Water Company system for its potable water supply. In 1992, TCE concentrations above drinking water standards were detected in *groundwater* samples from an off-Base private residence well within the *plume* boundary. A *CERCLA* emergency *removal action* was conducted to remove the well from service and connect the residence to the Base water supply system.

Nature and Extent of Contamination – Nebo South Plume

As described above, TCE is the predominant contaminant in the Nebo South area (see Figures 3, 4 and 5). The limited lateral and longitudinal migration of TCE appears to be the result of relatively tight soils, which slow the contaminant migration and inhibit *groundwater* flow. The off-Base *plume* interpretation based on 1996 data indicates that the leading edge of the *plume* extends *downgradient* from the Base boundary. However, *plume* interpretation based on 2004 data indicates that the extent of the TCE *plume* at Nebo South has decreased over the years as a result of the interim *AS/SVE* remedial actions in the *CAOC* 6 area. Continued operation of the *AS/SVE* system is expected to result in further reduction of the TCE *plume* at Nebo South to levels below the *MCL* for TCE.

Contamination Source Materials – Nebo South Plume

The results of the soil gas sampling presented in the Final Interim Remedial Action Construction Report (July 2004) indicated that TCE in soil gas would be predominant in the western portion of the Nebo South *plume* source area, *CAOC* 6. Although *VOCs* were not detected in soil samples at *CAOC* 6 during the *RI*, computer modeling conducted on soil gas data indicated that organic vapors in the *vadose zone* soils (soils above the *groundwater* level) could pose a continuing, long-term source of *VOCs* to *groundwater*. *Groundwater* contamination by *VOCs* has been confirmed at this site. The *vadose zone* at the Nebo South *plume* source area, *CAOC* 6, has been targeted for remedial action under *OU* 2 on the basis of these results.

SUMMARY OF SITE RISKS

A detailed Baseline Risk Assessment (BLRA) was performed as a part of the *RI/FS* activities for *OUs* 1 and 2 conducted in 1992 and 1994. A brief summary of risks posed to human health and the environment as a result of exposure to the Nebo South *groundwater plume* is presented below. The risk assessment was based on the *RI* results for the Nebo Main Base. The *RI* identified TCE, PCE, and 1,2-DCA as the primary chemicals of concern that were detected at concentrations exceeding their

WHAT IS RISK AND HOW IS IT CALCULATED?

A CERCLA human health risk assessment estimates the "baseline risk." This is an estimate of the likelihood of health problems occurring if no cleanup actions were taken at a site. To estimate the baseline risk at a CERCLA site, the DON undertakes a four-step process:

Step 1: Analyze Contamination
Step 2: Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

In Step 1, the DON looks at the concentrations of contaminants found at a site, as well as past scientific studies on the effects these contaminants have had on people (or animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies help the DON to determine which contaminants are most likely to pose the greatest threat to human health.

In Step 2, the DON considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure. Using this information, the DON calculates a "reasonable maximum exposure" (RME) scenario, which portrays the highest level of human exposure that could reasonably be expected to occur.

In Step 3, the DON uses the information from Step 2 combined with information on the toxicity of each chemical to assess potential health risks. The DON considers two types of risk: cancer risk and non-cancer risk. The likelihood of any kind of cancer resulting from a CERCLA site is generally expressed as an upper bound probability; for example, a "1 in 10,000 chance." In other words, for every 10,000 people that could be exposed, one extra cancer may occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than would normally be expected to from all other causes. For non-cancer health effects, the DON calculates a "hazard index." The key concept here is that a "threshold level" (measured usually as a hazard index of less than 1) exists below which non-cancer health effects are no longer predicted.

In Step 4, the DON determines whether site risks are great enough to cause health problems for people at or near the CERCLA site. The results of the three previous steps are combined, evaluated and summarized. The DON adds up the potential risks from the individual contaminants to estimate the overall potential risk. The overall potential risk is then compared to the EPA's target risk management range to make a risk management decision.

federal and/or state drinking water standards. Other *VOCs* detected at levels not exceeding federal or state standards included chloroform, bromoform, dibromochloromethane, and bromodichloromethane. Note that the interim remedial action at the Nebo South *plume* source area, *CAOC* 6, has resulted in a significant decrease in concentration and extent of the TCE *plume*. Therefore, the magnitude of current risk to human health and the environment is expected to be significantly less than the risks summarized below based on the *RI* data.

The Nebo South *plume* source area is vacant with the exception of a small covered area to house the *AS/SVE* system-related components. There are no active *groundwater* production wells at the Nebo Main Base. As indicated previously, an off-Base private residence well *downgradient* of the Nebo South *plume* source area, *CAOC* 6, was removed from service. The residence was connected to the Base water supply system. The major risk associated with the Nebo South *plume* was identified to be associated with the ingestion of the contaminated *groundwater* underlying the Nebo South *plume*.

Human Health Risk Characterization

The baseline risks to human health from exposure to contaminated *groundwater* from the Nebo South *plume* were calculated assuming that *groundwater* is used as a drinking water source without treatment, and that people are exposed to the maximum concentrations detected in the *plume*. For cancer risk, as many as 10 in 10,000 (1×10^{-3}) have the potential to develop cancer during their lifetimes. The calculated human health risk is above the EPA's target risk management range of 10^{-4} to 10^{-6}. This estimate was developed by taking into account various conservative assumptions about the likelihood of a person being exposed to *groundwater* contamination. For example, it assumes that the maximum detected contamination concentrations persist for the entire 30-year exposure duration. The majority of the risk was associated with TCE. As detailed in the BLRA, pre-remedial risks exceeded EPA's target risk range, chiefly due to the TCE concentration in *groundwater*. The interim remedial action, which are being finalized under the *OU* 2 Nebo South *ROD*, have significantly decreased these *groundwater* TCE concentrations. Therefore, with continued remediation, current and future actual risks are expected to remain well within EPA's target risk management range. The noncarcinogenic hazard index was less than 1.0 for both TCE and PCE.

Ecological Risk Characterization

An independent ecological risk assessment conducted by EPA Region IX concluded that exposure of potential ecological *receptors* to *VOCs* in *groundwater* is unlikely because *groundwater* does not discharge to local surface water and is therefore, not accessible to plants and animals. Thus, there is no complete exposure pathway to affect ecological *receptors* at Nebo South.

SCOPE AND ROLE OF THE ACTION

This Final Proposed Plan focuses on the final remedial alternative for the Nebo South *plume* under *OU* 2.

This Final Proposed Plan recommends using *AS/SVE* as the final action for addressing the Nebo South *plume* instead of implementing off-Base *groundwater* extraction and treatment. The proposed remedy has been demonstrated to be most effective through the *AS/SVE* pilot testing at the site. The extent of the TCE *plume* has been decreasing in recent years following issuing of the *OUs* 1 and 2 *ROD*. The need for containment of the off-Base *plume* by extraction and treatment is not recommended. It has been proven through recent data that an *AS/SVE* action will permanently reduce the toxicity, mobility, and volume of the contaminant *plume* associated with Nebo South that constitutes the principal threat at the site.

WHAT IS A "PRINCIPAL THREAT"?

The NCP establishes an expectation that the DON will use treatment to address the principal threats posed by a site wherever practicable (NCP Section 300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure. Contaminated groundwater generally is not considered to be a source material; however, non-aqueous phase liquids (NAPLs) in groundwater may be viewed as source material. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. The decision to treat these wastes is made on a site-specific basis through a detailed analysis of the alternatives using the nine remedy selection criteria. This analysis provides a basis for making a statutory finding that the remedy employs treatment as a principal element.

REMEDIAL ACTION OBJECTIVES

The remedial action objectives (RAOs) for the Nebo South *plume* (*OU* 2) are listed below.

- The RAO for *groundwater* at *CAOC* 6 is to restore the *groundwater* quality within and *downgradient* of the *CAOC* 6 area to *MCLs* for chemicals of concern. Cleanup of *groundwater* to *MCLs* would reduce baseline risk by 98 percent resulting in a residual risk of 1×10^{-5}. In the event that the *groundwater* concentrations for the chemicals of concern reach asymptotic levels (i.e., do not indicate statistically increasing or decreasing trendsthat are above MCLs) additional remedial technologies and/or system optimization will be evaluated.
- Reduce or eliminate further contamination of *groundwater* by addressing the *vadose zone* cleanup. The RAO for *vadose zone* cleanup at the Nebo South *plume* source area, *CAOC* 6, is to remove contaminant mass in the subsurface soils to the degree necessary to prevent further degradation of the *groundwater* above *groundwater* cleanup standards, and minimize the *aquifer* cleanup time.

Vadose zone modeling and site-specific data will be used as part of information to determine the "Shut-off" of the *AS/SVE* system.

A technical and economic feasibility (TEF) evaluation that supports achieving certain cleanup levels that are not technically or economically feasible was included in the FS Report for *OUs* 1 and 2 (June 1996). Based on the TEF analysis and risk assessment results, the DON concluded that achieving background levels of constituents in the groundwater is not technically or economically feasible, and established *MCLs* as the cleanup levels for groundwater remedial actions under this ROD consistent with the requirements, of 22 CCR 66264.94, 23 CCR 2550.4, and State Water Resources Control Board (SWRCB) Resolution Nos. 68-16 and 92-49.

Therefore, the selection of *MCLs* as the cleanup levels for *groundwater* is consistent with the procedure described in SWRCB Resolution 92-49.

LAND USE CONTROLS

To protect the human health and the environment, institutional controls are in place at Nebo South. These include access restrictions to prevent the on-Base use of untreated *groundwater* for domestic use, wellhead treatment for any existing water supply wells that fall within the area of the plume exceeding *MCLs* (currently none based on 2005 groundwater monitoring data), provide necessary information to the appropriate county agencies to identify any off-Base areas affected by *groundwater* contamination exceeding *MCLs*, and support the appropriate county agencies with any technical information needed for them to implement restrictions on construction and use of wells in the affected areas. These institutional controls will continue to be implemented.

SUMMARY OF ALTERNATIVES – NEBO SOUTH PLUME

To address the remediation of *groundwater* and *vadose zone* soil in the Nebo South *plume* area, five alternatives were developed and retained for detailed analysis and evaluation in the *OUs* 1 and 2 *ROD* signed in April 1998. A brief description of these alternatives is presented below. More details for each alternative can be found in the *OUs* 1 and 2 *ROD* (April 1998).

Alternative 1 – No Action

Under this alternative, MCLB Barstow would not take any action to clean up *groundwater* or limit contaminant migration, and existing site conditions would not change.

Alternative 2 – Institutional Controls/Groundwater Monitoring

For Alternative 2, access restrictions would be imposed to prevent the use of untreated *groundwater* in the area of the *plume* for drinking water purposes. Periodic long-term *groundwater* monitoring would be conducted to track movement of the *VOC plume*, monitor progress of the *VOC plume*, monitor progress of *VOC* mass reduction, and provide advanced warning to potentially affected *downgradient* users.

Alternative 3 – Groundwater and Vadose Zone Source Reduction (*AS/SVE* at *CAOC* 6)

This alternative involves operating the Phase I *AS/SVE* pilot study system. As noted earlier, Phase I and subsequent Phase II *AS/SVE* pilot study systems have been implemented successfully. The addition of Phase II, led to the term "Alternative 3-expanded" used throughout the remainder of this Proposed Plan. Recent *groundwater* monitoring data indicate that the Nebo South *plume* does not extend to off Base. *Groundwater* monitoring data following the implementation of the *AS/SVE* testing indicate a substantial decrease in TCE concentrations when compared to the 1996 TCE concentrations, with TCE concentrations in a majority of the wells below the *MCLs*.

Alternative 4 – Groundwater Removal (Extraction Wells at MCL/Background Boundary), Source Reduction at CAOC 6, Ex Situ Treatment, and Discharge

Alternative 4 builds upon Alternative 3 by expanding the pilot scale *AS/SVE* system to a full-scale *AS/SVE* treatment system to address source removal at the Nebo South *plume* source area, *CAOC* 6, and adding a *groundwater* pump-and-treat system to contain the leading edge of the *plume*. As noted earlier in this Proposed Plan, as well as the Draft Final Technical Memorandum – Evaluation of Off-Base Wells (April 2005), off-Base *groundwater* extraction proposed in this alternative could potentially result in off-Base migration of the Nebo South *plume*. In addition, recent *groundwater* monitoring data indicate that the Nebo South *plume* no longer extends off Base.

Alternative 5 – Groundwater Removal (Extraction Wells at MCL/Background Boundary), Ex Situ Treatment, and Discharge

This alternative provides an intermediate option between Alternatives 3 and 4. Alternative 5 consists of the *groundwater* extraction system in Alternative 4 to contain and extract the *groundwater* at the leading edge of the *plume*, as well as further evaluation of *AS/SVE* as a potential alternative.

This alternative was designated as an interim remedy in the *OUs* 1 and 2 *ROD* (April 1998). The interim remedy stated in the *OUs* 1 and 2 *ROD* (Alternative 5) has not been implemented to date because it was noted that extraction by off-Base wells could potentially result in the *VOC* contamination migrating off Base. The *OUs* 1 and 2 *ROD* states that if the *AS/SVE* is determined to be a feasible remedy and complies with the nine *NCP* criteria, the *AS/SVE* will be implemented at the Nebo South *plume* source area, *CAOC* 6.

Evaluation of Alternatives – Nebo South Plume

The Preferred Alternative to remediate the Nebo South Plume is an expanded version of Alternative 3 (Alternative 3-expanded) – *Groundwater* and *Vadose Zone* Source

Reduction (*AS/SVE* at *CAOC* 6) consisting of Phase I and Phase II *AS/SVE* described in the Final Interim Remedial Action Construction Report (July 2004). A conceptual diagram illustrating the *AS/SVE* technology is shown on Figure 6.

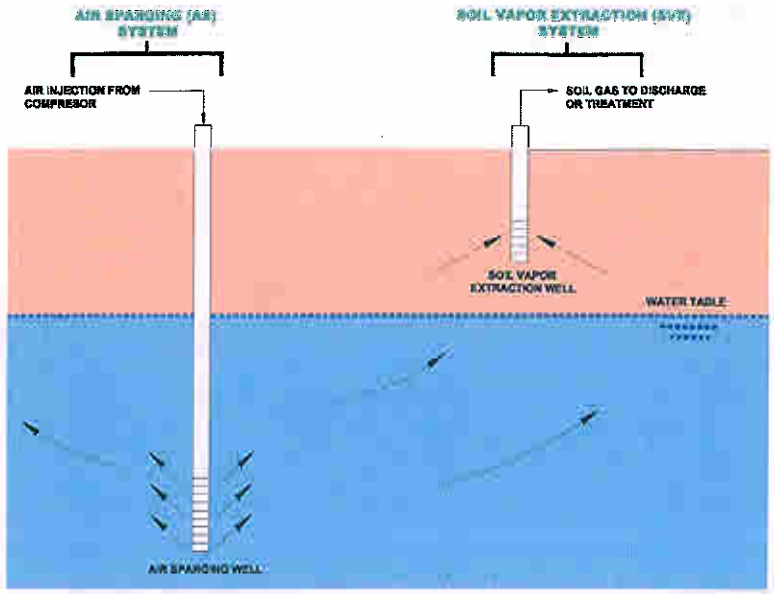

Figure 6 – Schematic of AS/SVE System

The remainder of this section addresses the performance of the preferred alternative against eight of the nine EPA evaluation criteria and how it compares to the other alternatives considered.

Because the No Action alternative is not protective of human health and the environment, it is not considered in the evaluation. Thus, when the term "all alternatives" is used below, it does not include the No Action alternative.

Overall Protection of Human Health and the Environment

The calculated human health risk for each alternative is within the EPA's target risk range. Given the conservative nature of the assessment, it is likely that the actual risk posed to a hypothetical residential *receptor* would be even lower. Assuming that engineering controls are effective in off-Base areas, all alternatives are considered to be protective of human health and the environment. The off-Base engineering controls for the Nebo South *plume* included removing the off-Base residential water supply well from service and connecting the residence to the Base water supply system.

Compliance with *ARARs*

All alternatives, except Alternative 1, comply with location-specific *ARARs* because no ecological or cultural resources are threatened by the *groundwater* contamination. All alternatives, except Alternative 1, also comply with action-specific *ARARs*; specifically, state antidegradation *ARARs* for treated *groundwater* discharges and *VOC* emissions control. Except for Alternative 2, all the alternatives comply with federal and state drinking water standards (chemical-specific *ARARs*). With the implementation of institutional controls, Alternative 2 complies with federal and state drinking water standards applied at the tap. However, Alternative 2 does not comply with chemical-specific *ARARs* because this alternative does not capture portions of the *plume* above *MCLs*.

Long-term Effectiveness and Permanence

All alternatives provide moderate to high long-term effectiveness and permanence. As stated in the *OUs* 1 and 2 *ROD* (April 1998) based on the *RI/FS* data, Alternative 2 may require a significantly long duration to meet drinking water standards in the *aquifer* and, therefore, can only achieve effective long-term risk reduction by restricting the use of untreated *groundwater* for drinking water and providing wellhead treatment when warranted. If these control measures cannot be implemented or maintained, Alternative 2 would not comply with this criterion.

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES

Overall Protectiveness of Human Health and the Environment determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.

Compliance with ARARs evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.

Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.

Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.

Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

State/Support Agency Acceptance considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.

Community Acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

Reduction of Toxicity, Mobility, or Volume of Contaminants

Alternatives 3-expanded, 4, and 5 achieve moderate to high reduction of toxicity, mobility, or volume through active pump-and-treat and *AS/SVE* remediation. The ongoing pilot test for Alternative 3-expanded has resulted in substantial decrease in the *groundwater VOC* concentrations. As stated in the *OUs* 1 and 2 *ROD* (April 1998) based on the *RI/FS* data, Alternative 2 can only achieve reduction of toxicity, mobility, and volume over a significantly long period of time and do not satisfy the statutory preference for treatment.

Short-term Effectiveness

Because *groundwater* cleanup actions require relatively long timeframes to restore the aquifer, short-term risks are the same as current risks. It should be noted that the Phase I and Phase II *AS/SVE* testing results indicate that the time required for *groundwater* cleanup using Alternative 3-expanded would be less than the timeframes required using alternatives that involve *groundwater* extraction and treatment (Alternatives 4 and 5). Based on the *AS/SVE* system data, as well as groundwater monitoring data, it is estimated that it would take approximately 3 years to achieve the RAOs. All alternatives rely on institutional controls for short-term effectiveness of community protection. Such controls are more effective on Base. All alternatives comply with worker protection requirements and result in a minimal environmental impact.

Implementability

Pump-and-treat and *AS/SVE* are proven, commercially available, readily implementable, and simple-to-operate technologies. Constructability concerns at or near the Nebo South *plume* source area, *CAOC* 6, do not appear to be an issue. However, hydrogeological conditions at the site can significantly limit the effectiveness of *groundwater* pump-and-treat remedies at Nebo South *plume* source area, *CAOC* 6. The results of the aquifer testing revealed that the soil conditions beneath the water table at *CAOC* 6 change and are not uniformly conducive to *groundwater* extraction. No construction-related problems are anticipated during installation of on-Base extraction wells and treatment systems. Construction of off-Base extraction wells will require gaining access through coordination with private land owners and local officials. Many of the alternatives involve relatively long cleanup durations as described in the *OUs* 1 and 2 *ROD*. The Phase I and Phase II *AS/SVE* testing results indicate that the time required for *groundwater* cleanup using Alternative 3-expanded would be less than the timeframes required using alternatives that involve *groundwater* extraction and treatment (Alternatives 4 and 5).

Cost

The existing Phase I and II *AS/SVE* system is considered adequate to achieve this goal and thus, no additional capital costs are expected to be involved at this time using Alternative 3-expanded. Alternatives 4 and 5, while not readily suitable to implement because of the current *plume* migration and the relatively tight and low- yielding *aquifer* characteristics, may require significant capital costs. These capital costs for Alternatives 4 and 5 include installation of *groundwater* extraction wells and piping to convey the extracted *groundwater* to the treatment system in the Nebo North area. The *Present Worth* costs for Alternatives 4 and 5 stated in the *OUs* 1 and 2 *ROD* (April, 1998) are $15.1 million and $5.5 million, respectively. The estimated net *Present Worth* cost for the Alternative 3-expanded is approximately $670,000. The *Present Worth* cost for the Alternative 3-expanded is less when compared to Alternatives 4 and 5 because of the cleanup time frame and the fact that no additional capital costs are involved at this time.

State Acceptance

The Draft Technical Memorandum – Evaluation of Off-Base Extraction Plan (April 2005) (*OU* 2) included the DTSC and Water Board comments on the draft version of this document. This document concluded that continued implementation of *AS/SVE* would result in chemical of concern concentrations at or below the *MCL* levels in the Nebo South area.

Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the public comment period ends and will be described in the *ROD* for the site.

SUMMARY OF THE PREFERRED ALTERNATIVE – NEBO SOUTH PLUME

The Preferred Alternative to remediate the Nebo South *plume* is Alternative 3-expanded – *Groundwater* and *Vadose Zone* Source Reduction (*AS/SVE* at *CAOC* 6) consisting of Phase I and Phase II *AS/SVE* described in the Final Interim Remedial Action Construction Report (July 2004).

Rationale

The Preferred Alternative was selected over other alternatives because it is expected to achieve substantial and long-term risk reduction through treatment.

As discussed in the Draft Final Technical Memorandum – Evaluation of Off-Base Extraction Plan (April 2005) (*OU* 2), *groundwater* monitoring data, following the implementation of the *AS/SVE* testing, indicate a substantial decrease in TCE concentrations when compared to the 1996 TCE concentrations, with TCE concentrations in a majority of the wells below the *MCLs*. Calculations based on the *VOC* mass removed by the *AS/SVE* system and *groundwater* concentrations observed in the monitoring wells indicate that it would take approximately 3 years for the *groundwater* concentrations in the Nebo South *plume* to reach levels at or below *MCLs*. The existing *AS/SVE* system is considered adequate to achieve this goal and it would be the most cost-effective because no additional capital costs would be involved.

Based on the pilot test results, the Preferred Alternative is expected to reduce the risk within a reasonable timeframe and at less cost when compared to other remedial alternatives under consideration. Based on the information available at this time, the DON believes that the Preferred Alternative would be protective of human health and the environment, would comply with *ARARs*, would be cost-effective, and would use permanent solutions and alternative treatment technologies to the maximum extent practicable. Because it would treat the source materials constituting principal threats, the remedy also would meet the statutory preference for the selection of a remedy that involves treatment as a principal element. The Preferred Alternative may be modified in response to public comment or new information.

GLOSSARY

Administrative Record – A collection of all documents used to select and justify the cleanup of sites at MCLB Barstow. These documents are available for public review.

Aquifer – A layer of rock or soils located beneath the ground surface capable of storing water within cracks and pore spaces. When water contained within an aquifer is of sufficient quantity and quality, it can be used for drinking and other purposes. The water contained in an aquifer is called groundwater.

ARAR – Applicable or Relevant and Appropriate Requirement – The federal and state laws and regulations that must be followed for the selected cleanup remedy. Generally referred to as ARARs.

AS/SVE – Air Sparging/Soil Vapor Extraction – These are methods of removing *VOCs* from contaminated groundwater and soil. Air sparging is the injection of air into the *saturated zone* to volatilize and strip *VOCs* from groundwater. Soil vapor extraction is the application of a vacuum in subsurface soils in order to remove *VOCs* from the soil. At MCLB Barstow, the two systems are being used together to remove contaminants.

Background – Naturally occurring levels of a contaminant in groundwater.

CAOC – CERCLA Area of Concern – Title used to identify each individual site at MCLB Barstow, for example, CAOC 26.

CERCLA – Comprehensive Environmental Response, Compensation and Liability Act of 1980 – Commonly referred to as Superfund, authorizes federal action to respond to the release, or threat of release, into the environment of hazardous substances, pollutants, or contaminants that may present an imminent or substantial danger to public health or welfare.

Downgradient – A term used to refer to the placement of a groundwater well at a location downstream of a waste site (i.e., where groundwater flows away from the site).

Ex Situ Treatment – A method of reducing the toxicity or amount of contaminants in a particular media (e.g., groundwater) outside of its original location. Pump-and-treat technologies, where groundwater is pumped out of the ground and the contaminants removed, are examples of ex situ treatments.

FS – Feasibility Study – An engineering evaluation of technologies that may be used to clean up a site. The study looks at site conditions, potential technical problems, costs, and human and ecological impacts to determine how effective the technologies may be.

Groundwater – Water beneath the ground surface that fills spaces between soil particles. Groundwater is often used as a source of drinking water through municipal or domestic wells.

MCL – Maximum Contaminant Level – The concentration of contaminants in groundwater established by the Safe Drinking Water Act below which groundwater is considered safe to drink.

NCP – National Oil and Hazardous Substances Pollution Contingency Plan – Regulation issued by the U.S. Environmental Protection Agency to implement the requirements of CERCLA.

NPL – National Priorities List – A list of hazardous waste sites that have been evaluated according to the Hazard Ranking System (HRS) and given a score of 28.5 or greater. The EPA uses the HRS to decide whether a site should be placed on the NPL. The HRS ranks each site and assigns a score. The score is derived by comparing the relative hazards for different sites, considering the site's impact on groundwater, surface water, and air, as well as the number of people potentially affected by contamination.

OU – Operable Unit – A group of sites that may be based on similar characteristics such as type of wastes, location, or anticipated type of cleanup.

Plume – A defined volume of groundwater in an aquifer containing chemical contamination.

Present Worth Cost – Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

RCRA Facility Assessment – A process that identifies releases or potential releases requiring further investigation under the RCRA Corrective Action program.

Receptors – A population (human or biota) that is environmentally exposed or potentially exposed to contaminants.

Removal Action – Cleanup that generally focuses on the mitigation of near-term threats from a release of hazardous substances or threat of release.

RI – Remedial Investigation – Field study that includes collecting soil and groundwater samples to evaluate what type of and how much contamination is present at a site.

ROD – Record of Decision – A report that documents how a site will be cleaned up and why the cleanup method was selected.

Saturated Zone – Subsurface rock or soils in which cracks or the space between grains is filled with groundwater.

Section 117(a) of CERCLA – The section of the law that specifies the required activities to provide opportunity for public participation at CERCLA sites.

Upgradient – The term used to describe the placement of a groundwater well at a location upstream of a site (i.e., where groundwater flows toward the site).

Vadose Zone – Rock or soils between the ground surface and the groundwater table. Also known as the unsaturated zone.

VOCs – Volatile Organic Compounds – Chemical compounds that contain the element carbon and evaporate easily into air at room temperature. The VOCs that were found most often and at the highest levels in the groundwater during the RI/FS studies were: trichloroethene (TCE), tetrachloroethene (PCE), and 1,2-dichloroethane (1,2-DCA).

FOR MORE INFORMATION

If you have any questions about the MCLB Barstow Nebo South groundwater, please contact:

Commanding Officer
Marine Corps Logistics Base
Attention: Ms. Carmela Gonzalez, Environmental Division
P.O Box 110170
Barstow, CA 92311-5050
Telephone: (760) 577-6744
Fax: (760) 577-6256
e-mail: Carmela.Gonzalez @usmc.mil

COMMUNITY PARTICIPATION

The DON, EPA, the DTSC, and the Water Board provide information regarding the cleanup of Nebo South groundwater to the public through open house meetings, the Administrative Record file for the site, and announcements published in the *Desert Dispatch*, the *Victorville Daily Press*, and the *San Bernardino Sun*, and announced in the area radio and television stations. The DON, EPA, and the Water Board encourage the public to gain a more comprehensive understanding of the sites and the IR activities that have been conducted at MCLB Barstow.

The dates for the public comment period; the date, location, and time of the open house meeting; and the locations of the Administrative Record file are provided on the front page of this Proposed Plan.

There are two ways for you to provide your comments during the public comment period (June 21, 2006, to July 21, 2006). You may use the attached comment form to send written comments to the address listed below and included on the comment form:

Commanding Officer
Marine Corps Logistics Base
Attention: Ms. Carmela Gonzalez, Environmental Division
P.O Box 110170
Barstow, CA 92311-5050
Telephone : (760) 577-6744
Fax : (760) 577-6256
e-mail: Carmela.Gonzalez @usmc.mil

Alternatively, you may submit your comments during the open house meeting on June 28, 2006, from 7 p.m. to 9 p.m. at the Ramada Inn, located at 1511 E. Main Street, Barstow, CA (Phone: 760-256-5673).

After the public comment period is over, the DON, EPA, the DTSC, and the Water Board will review and consider the submitted comments before making a final decision on the remedies to be used at the sites. All site-related documents are available for review at the Administrative Record locations shown on the front page of the Proposed Plan.

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for the MCLB Barstow Nebo South Groundwater is important to the DON, EPA, DTSC, and the Water Board. Comments provided by the public are valuable in helping the DON, EPA, DTSC, and the Water Board select final cleanup remedies for the sites.

You may use the space below to write your comments, then fold, staple, and mail. Comments must be postmarked by (June 21, 2006 to July 21, 2006). If you have any questions regarding the comment period, please contact Ms. Carmela Gonzalez, MCLB Barstow Installation Restoration Program Manager, at (760) 577-6744. Those with electronic communication capabilities may submit their comments to the DON via the Internet at the following e-mail address: Carmela.Gonzalez @usmc.mil.

Name _____

Address _____

City _____

State _____ **Zip** _____

Fold along dotted line

Commanding Officer
Marine Corps Logistics Base
Attention: Ms. Carmela Gonzalez, Environmental Division
P.O Box 110170
Barstow, CA 92311-5050